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**459. Proposed by C. N. SCHMALL, New York City.**

In a right triangle  $ABC$ , right-angled at  $C$ , a point  $F$  is taken in the side  $CB$  and perpendiculars  $CD$  and  $FE$  are dropped on the hypotenuse  $AB$ . Prove  $AD \cdot AE + CD \cdot EF = \overline{AC}^2$ .

## CALCULUS.

When this issue was made up, solutions had been received for numbers 366-377

**378. Proposed by ELBERT H. CLARKE, Purdue University.**

The area of the curved surface generated by the revolution about  $OX$  of the portion of the curve  $y = x^n$  which extends from the origin to the point  $(1, 1)$  is given by the formula

$$A = 2\pi \int_0^1 x^n \sqrt{1 + n^2 x^{2n-2}} dx.$$

Our geometric intuition would tell us that the limit of this area as  $n$  becomes infinite is  $\pi$ . Give a strict analytic proof that

$$\lim_{n \rightarrow \infty} \int_0^1 x^n \sqrt{1 + n^2 x^{2n-2}} dx = \frac{1}{2}.$$

**379. Proposed by C. N. SCHMALL, New York City.**

Express the equation of the folium,  $x^3 + y^3 = 3axy$ , in parametric form and find the area of the loop.

(From E. B. Wilson's *Advanced Calculus*, p. 296, ex. 5.)

## MECHANICS.

When this issue was made up, solutions had been received for numbers 297, 301, and 302

**303. Proposed by CLIFFORD N. MILLS, Brookings, South Dakota.**

A pile-driver weighing 500 pounds falls through 10 ft. and drives a pile weighing 400 pounds 3 inches into the ground. Show that the average force of the blow is  $11,111\frac{1}{3}$  pounds.

## NUMBER THEORY.

When this issue was made up, solutions had been received for numbers 224, 225, 226, and 229

**228. Proposed by HERMON C. KATANIK, Indianapolis, Ind.**

Deduce a formula for the difference between any two squares, and thus show that (1) The difference between any two consecutive squares is of the form  $2p + 1$ ; (2) The difference between any two squares is even or odd according to whether they are separated by an odd or even number of squares; (3) The differences of the squares of the consecutive terms of any arithmetic progression form another arithmetic progression.

**229. Proposed by WALTER C. EELLS, U. S. Naval Academy.**

If  $p$  and  $q$  are integers and  $p$  is prime and positive, find the condition on  $q$  that the equation  $p^x = qx$  shall have integral solutions, solve for  $x$ , and show that for a special value of  $p$  it has two solutions for a given  $q$ , otherwise only one.

## SOLUTIONS OF PROBLEMS.

## ALGEBRA.

**418. Proposed by CLIFFORD N. MILLS, Brookings, South Dakota.**

Form the algebraic equation whose roots are

$$a_1 = 2 \cos\left(\frac{2\pi}{15}\right), \quad a_2 = 2 \cos\left(\frac{4\pi}{15}\right), \quad a_3 = 2 \cos\left(\frac{8\pi}{15}\right), \quad a_4 = 2 \cos\left(\frac{14\pi}{15}\right).$$